View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Research Online

University of Wollongong
Research Online

Faculty of Science, Medicine and Health - Papers: part A
Faculty of Science, Medicine and Health

1-1-2013

Unmanned aerial optical systems for spatial monitoring of Antarctic mosses

Arko Lucieer
University of Tasmania, arko.lucieer@utas.edu.au

Darren Turner
University of Tasmania

Tony Veness
University of Tasmania

Zbynek Malenovky
University of Tasmania, zbynek@uow.edu.au

Steve Harwin
University of Tasmania

See next page for additional authors

Follow this and additional works at: https://ro.uow.edu.au/smhpapers

Part of the Medicine and Health Sciences Commons, and the Social and Behavioral Sciences Commons

Recommended Citation
Lucieer, Arko; Turner, Darren; Veness, Tony; Malenovky, Zbynek; Harwin, Steve; Wallace, Luke; Kelcey, Josh; and Robinson, Sharon A., "Unmanned aerial optical systems for spatial monitoring of Antarctic mosses" (2013). *Faculty of Science, Medicine and Health - Papers: part A*. 2529.
https://ro.uow.edu.au/smhpapers/2529

Research Online is the open access institutional repository for the University of Wollongong. For further information contact the UOW Library: research-pubs@uow.edu.au

Unmanned aerial optical systems for spatial monitoring of Antarctic mosses

Abstract

Abstract of presetation at EGU General Assembly 2013, held 7-12 April, 2013 in Vienna, Austria.

Disciplines

Medicine and Health Sciences | Social and Behavioral Sciences

Publication Details

Lucieer, A., Turner, D., Veness, T., Malenovky, Z., Harwin, S., Wallace, L., Kelcey, J. & Robinson, S. (2013). Unmanned aerial optical systems for spatial monitoring of Antarctic mosses. EGU General Assembly 2013 (pp. 1-1). United States: ADS Abstract Service.

Authors

Arko Lucieer, Darren Turner, Tony Veness, Zbynek Malenovky, Steve Harwin, Luke Wallace, Josh Kelcey, and Sharon A. Robinson

This conference paper is available at Research Online: https://ro.uow.edu.au/smhpapers/2529

Geophysical Research Abstracts
Vol. 15, EGU2013-7795, 2013
EGU General Assembly 2013
© Author(s) 2013. CC Attribution 3.0 License.

Unmanned aerial optical systems for spatial monitoring of Antarctic mosses

Arko Lucieer (1), Darren Turner (1), Tony Veness (1), Zbynek Malenovsky (1), Stephen Harwin (1), Luke Wallace (1), Josh Kelcey (1), and Sharon Robinson (2)

(1) School of Geography and Environmental Studies, University of Tasmania, Hobart, Australia (arko.lucieer@utas.edu.au), (2) Institute for Conservation Biology, University of Wollongong, Wollongong, Australia (sharonr@uow.edu.au)

The Antarctic continent has experienced major changes in temperature, wind speed and stratospheric ozone levels during the last 50 years. In a manner similar to tree rings, old growth shoots of Antarctic mosses, the only plants on the continent, also preserve a climate record of their surrounding environment. This makes them an ideal bio-indicator of the Antarctic climate change. Spatially extensive ground sampling of mosses is laborious and time limited due to the short Antarctic growing season. Obviously, there is a need for an efficient method to monitor spatially climate change induced stress of the Antarctic moss flora. Cloudy weather and high spatial fragmentation of the moss turfs makes satellite imagery unsuitable for this task. Unmanned aerial systems (UAS), flying at low altitudes and collecting image data even under a full overcast, can, however, overcome the insufficiency of satellite remote sensing. We, therefore, developed scientific UAS, consisting of a remote-controlled micro-copter carrying on-board different remote sensing optical sensors, tailored to perform fast and cost-effective mapping of Antarctic flora at ultra-high spatial resolution (1-10 cm depending on flight altitude). A single lens reflex (SLR) camera carried by UAS acquires multi-view aerial photography, which processed by the Structure from Motion computer vision algorithm provides an accurate three-dimensional digital surface model (DSM) at ultra-high spatial resolution. DSM is the key input parameter for modelling a local seasonal snowmelt run-off, which provides mosses with the vital water supply. A lightweight multispectral camera on-board of UVS is collecting images of six selected spectral wavebands with the full-width-half-maximum (FWHM) of 10 nm. The spectral bands can be used to compute various vegetation optical indices, e.g. Difference Vegetation Index (NDVI) or Photochemical Reflectance Index (PRI), assessing the actual physiological state of polar vegetation. Recently we have implemented in a larger UAS a micro-Hyperspec imaging spectrometer (Headwall Inc., the USA) acquiring so-called hyperspectral image data of 162 or 324 wavebands between 399 and 998 nm. Continuous reflectance of narrow spectral bands (FWHM of about 4 nm) allows quantification of main moss bio-chemical spectral absorbents, i.e. foliar pigments or turf water content, but also estimation of the steady-state chlorophyll fluorescence, indicating their actual photosynthetic activity. Finally, a small FLIR thermal camera carried by UAS provides spatial temperature changes of the moss surface. Such a broad range of the unmanned aerial optical systems enables a regular and time efficient investigation of the spatio-temporal changes in polar moss ecosystems, indicating the influence of the progressing climate change in Antarctica.